

The Xen Project logo features a green circular icon with a white 'X' inside, positioned to the left of the text.

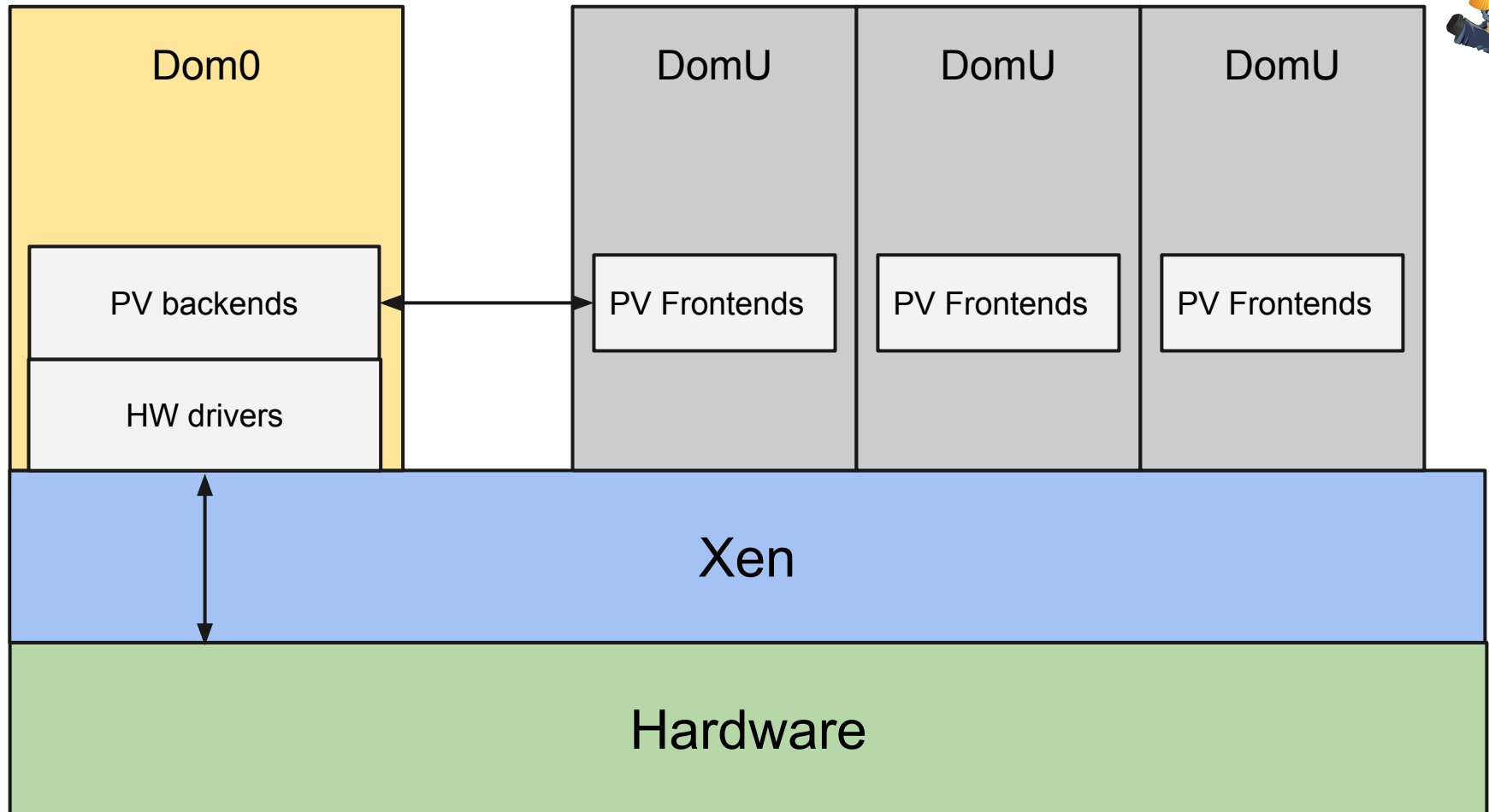
Xen on **ARM**
Project

Stefano Stabellini

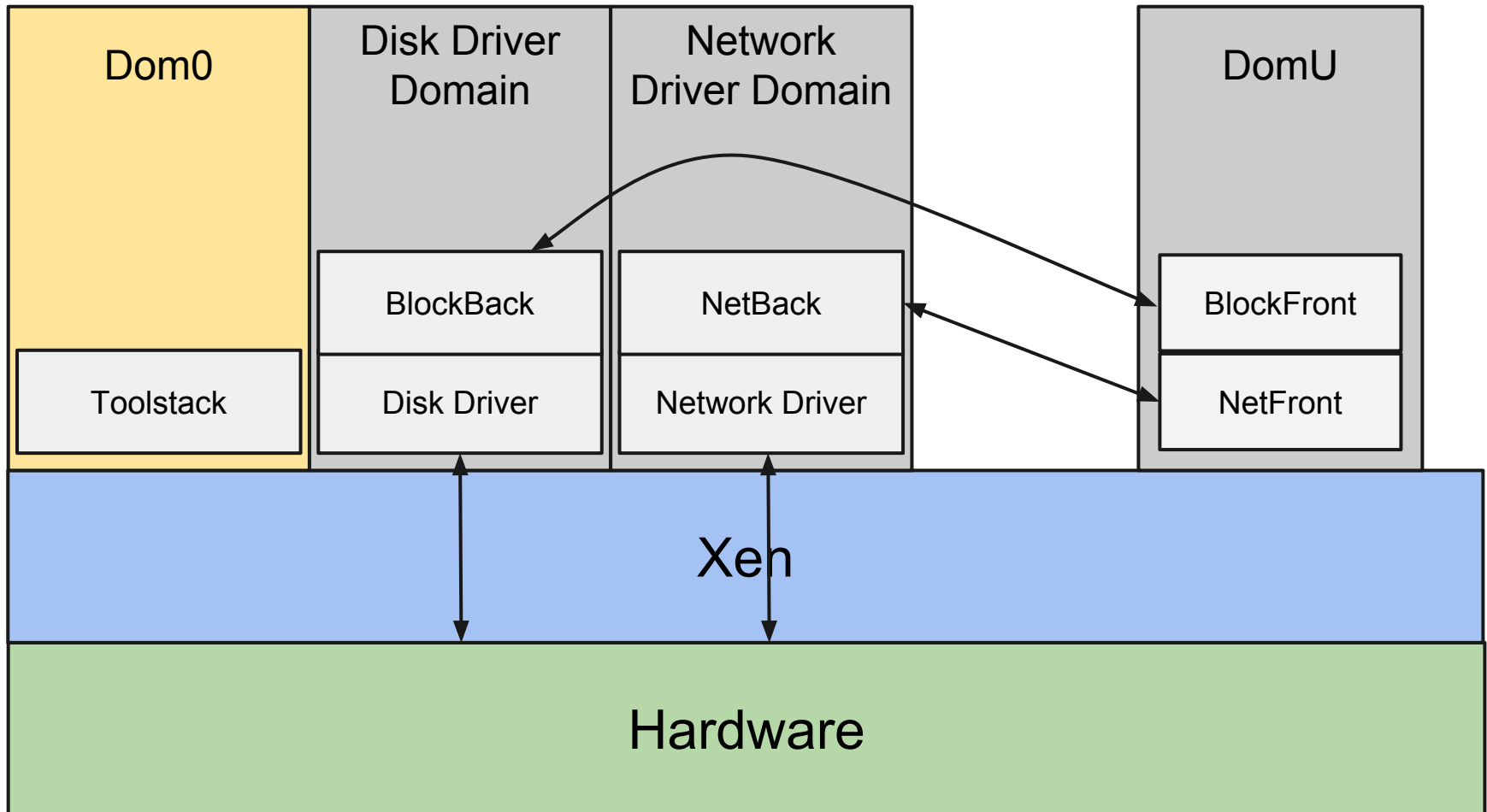
What is Xen?

- a type-1 hypervisor
- small footprint (less than 90K LOC)
- GPLv2
- powers the largest public clouds in production

Xen Architecture



Xen Architecture: driver domains



Xen Architecture: driver domains

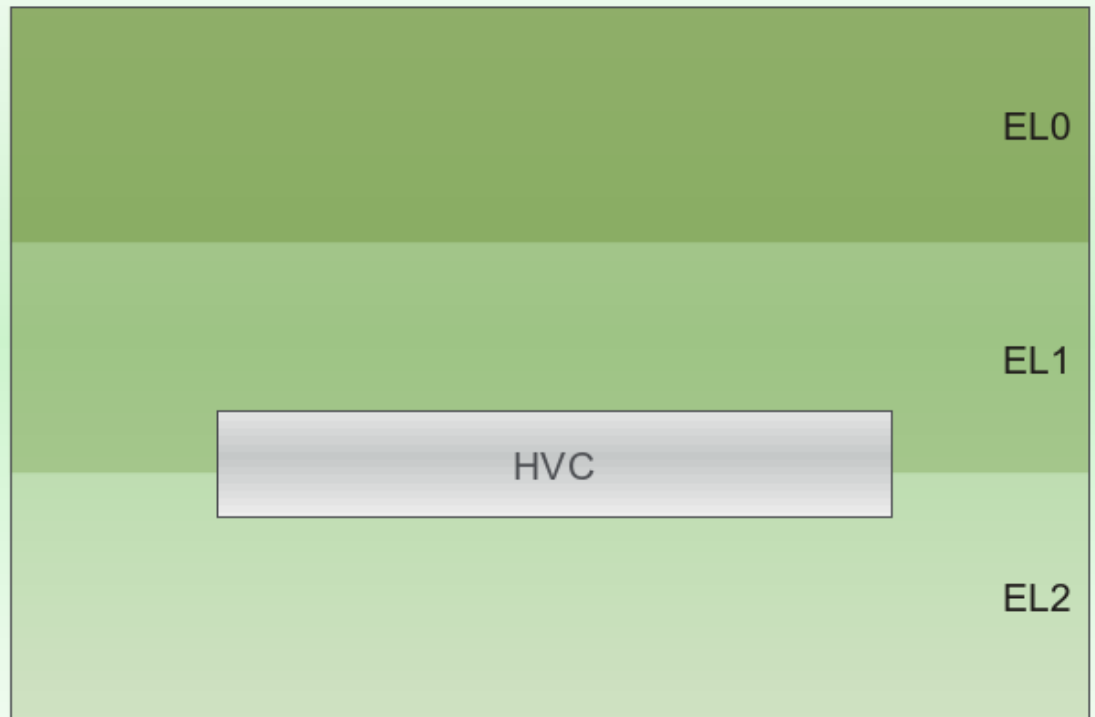
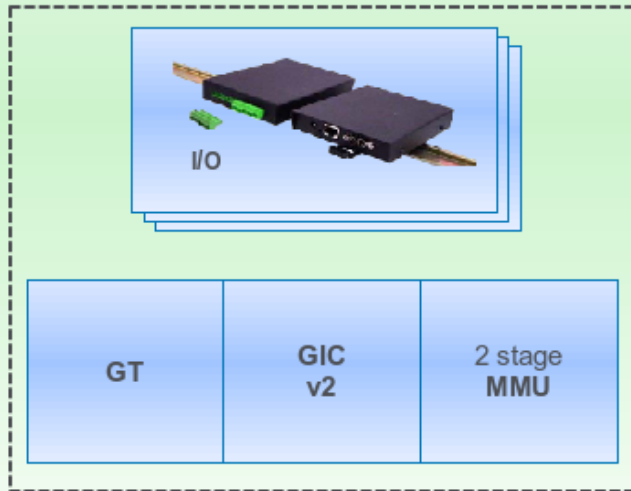
- disaggregation and componentization
- security and isolation
- resilience
- hardware vendors can run their drivers in separate VMs
 - could run in a RTOS environment
 - hidden from the user
 - media codecs, crypto keys, etc.

Xen on ARM: not just a port

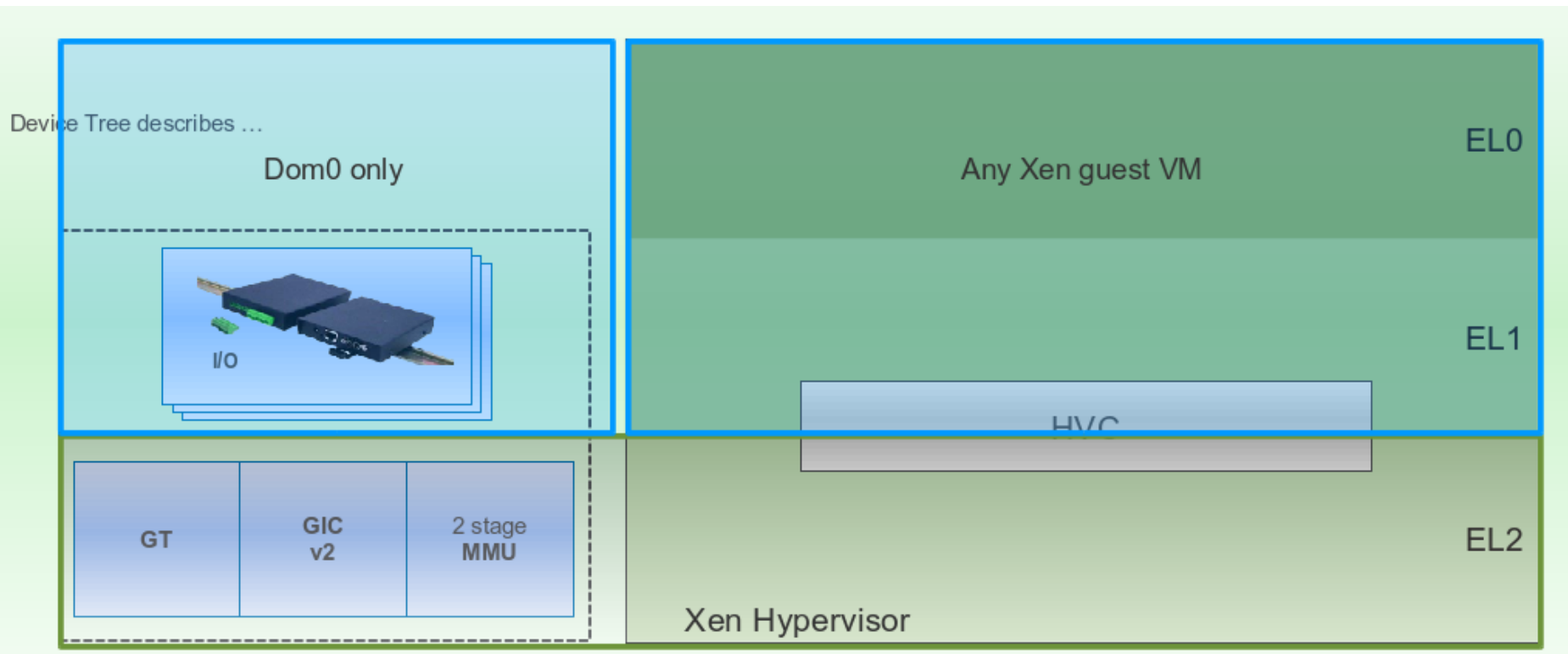
- a lean and simple architecture
 - removed cruft accumulated during the years
 - no emulation, no QEMU
 - use PV drivers for IO as early as possible
 - one type of guest
 - exploit the hardware as much as possible
- a very good match for the hardware
- clean architecture = small code base

Xen on ARM architecture

Device Tree describes ...



Xen on ARM architecture



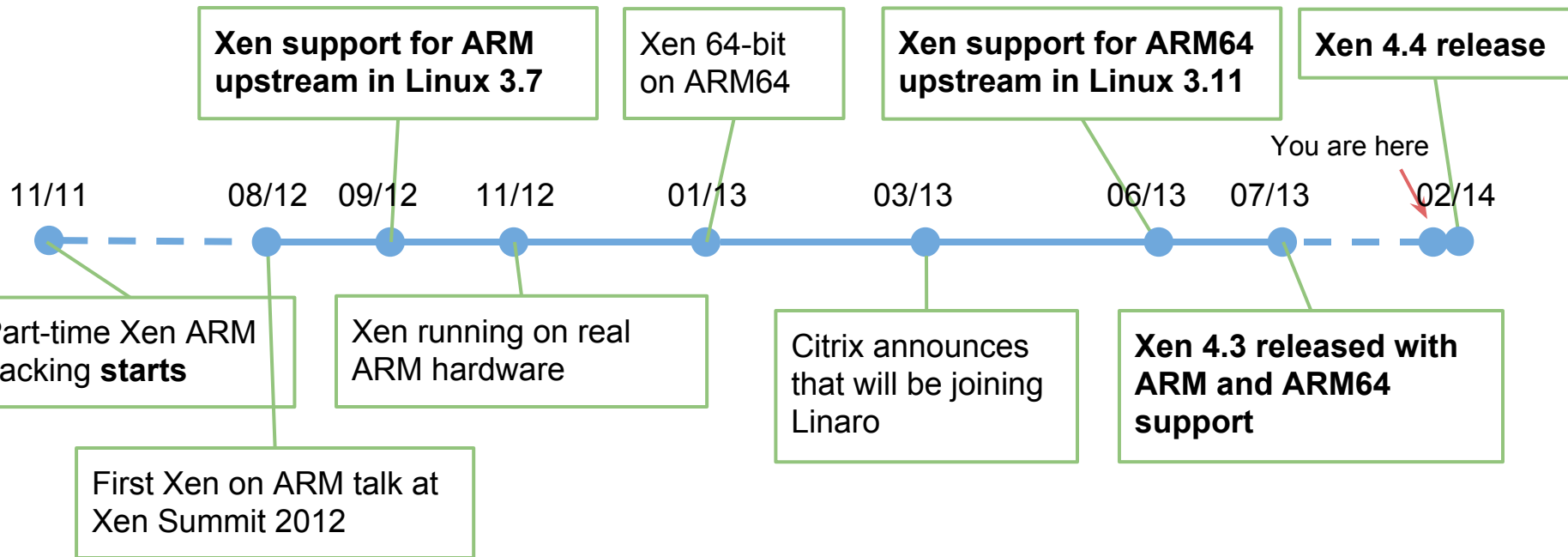
Code size

sometimes smaller is better

	Common	ARMv7	ARMv8	Total
xen/arch/arm	5,122	1,969	821	7,912
C	5,023	406	344	5,773
ASM	99	1,563	477	2,139
xen/include/asm-arm	2,315	563	666	3,544
TOTAL	7,437	2,532	1,487	11,456

- X86_64-bit: ~120,000LOC (~4,000 ASM)
- ARM code \approx **1/10** x86_64 code

Achievements of the last 18 months



A growing community

Xen-devel ARM traffic from Jan 2013:

- 5663 emails: 472 emails per month!
- 43% of which are **not** from Citrix



Xen Hardware support

Xen 4.4-rc2:

- Versatile Express Cortex A15
- Arndale board
- ARMv8 FVP
- Allwinner SunXi (Cubieboard 2)
- TI OMAP5
- Applied Micro X-Gene

Porting Xen to a new board

- Xen only relies on GIC and GT
- platform specific code in Xen is reduced to:
 - secondary cpus bring up
 - UART drivers
 - any platform specific bootup quirks (ideally none)

Xen features

Xen 4.4-rc2:

- 64-bit guest support on ARMv8
- stable hypercall ABI
- multiboot support
- PSCI support

Xen 4.3:

- basic lifecycle operations
- memory ballooning
- scheduler configurations and vcpu pinning

Linux features

Linux v3.13:

- SWIOTLB
- PV framebuffer, mouse and keyboard

Linux v3.11:

- dom0 and domU support
- 32-bit and 64-bit support
- SMP support
- PV disk, network and console

Android on Xen on ARM

- Android is based on the Linux kernel
 - KitKat is based on Linux 3.8: just recompile the kernel to get Xen on ARM support!
- Additional work needed to support client devices (compass, GPS, etc.) on multiple VMs
 - easy to export 1 device to 1 VM
 - otherwise each type of device needs a PV drivers pair

PV Protocols

- shared ring protocol
- software interrupts AKA event channels
- consensual memory sharing: grant table
- easy to write
- plenty of examples
 - network, block, console, PCI, keyboard, mouse, framebuffer, sound, SCSI, USB, ...

Porting other OSes to Xen on ARM

- No invasive modifications needed
- only some new drivers:
 - grant table, event channels, xenbus
 - PV drivers for network, block, console, etc.
- BSD drivers already exist in NetBSD and FreeBSD, can they be reused?
- FreeBSD port to Xen on ARM in progress

A look into the future

- SMMU-500 support in Xen
- device assignment
- UEFI booting
- ACPI support

Xen for automotive: why?

- type-1
- small footprint
 - small codebase
 - no QEMU, no emulation
- driver domains / service VMs
 - componentization
 - security
 - support for legacy drivers
- supports Linux out of the box
- easy to port other OSes to Xen on ARM

More Information

- <http://www.xenproject.org>
- Xen on ARM @wiki.xenproject.org [goo.gl/FKNXe](http://wiki.xenproject.org/wiki/FKNXe)
- <http://lists.xen.org/mailman/listinfo/xen-devel>

Questions?

Fin.